# LECTURE.

GENTLEMEN,

Standing in the place occupied for so many years, and with so much usefulness to Society, by the late Mr. Brookes; and seeing before me a great number of those whom he instructed, and to whom much of his knowledge and celebrity have descended, I feel a weight of responsibility which would prevent my undertaking the duties of his successor, but for your kind assurances of support.

This Museum once contained so many precious things—specimens so numerous and of such value—that it seems impossible they could have been collected and preserved by one man. At that time, the eulogy of Brookes had been easy: it was only to say, in the words of the epitaph inscribed in St. Paul's to the memory of its great architect—"Do you seek his monument, look around you." These treasures, the result of unprecedented labor, have been scattered. Circumstances compelled him, who spent all his fortune and almost all his life in their collection, to dispose of them, in a manner and at a time which cannot be recollected without deep regret. Still he, who in industry in his profession, was second to none, shall live honorably in the remembrance of Posterity; and the name of Brookes will be inscribed in the annals of Science with those of Buffon and Hunter. With this conviction, at once consolatory and encouraging; and with the consciousness that the successful cultivation of Anatomy is the best tribute we can pay to the memory of Brookes, I proceed to introduce this Science to your study.

The first thing to be done in the study of any subject, is to define it; to mark its limits as correctly as possible: so that it may be complete, and yet, as far as is practicable, unmixed with other matters.

What is Anatomy? The term, in its common acceptation, designates, at once, either the physical structure and composition of Man; or, the knowledge of that structure; or, one of the means of acquiring such knowledge: and, to the last, which is often called dissection, its etymology makes it most applicable; because it is derived from *ava*, and *τεμνω*.

We have examples of these different significations when we say: a

person has a good knowledge of Anatomy, meaning the *structure* of the body; that Anatomy is useful, meaning the *knowledge* of that structure; that Anatomy is not unattended with danger, meaning *dissection*. But it has a more extensive and important signification, especially among men of Science. By those who have thought most deeply and written most usefully on Anatomy, the term is employed to designate the Science of Organization; and, we take it in this signification, although, etymologically, it may not be so applicable as the word Organography. If, even, we used it in the restricted senses just mentioned, I should still have to introduce Anatomy to you as a part of the Science of Organization: and as, to know a part, you must have some conception of the whole; an Introductory Lecture ought still, it seems to me, to have for its object to give you that conception. In either case, then, our course would be the same.

The Bodies of the Universe which have organs, exercising, for a time, certain actions, so independently of external circumstances that the aggregate of these actions is called life, are termed Organized; and the knowledge of the manner in which they are organized, or of the laws and principles of their construction is the Science of Organization. Embracing all Organized Beings, it has been, of necessity, subjected to many divisions and subdivisions for the purpose of convenience; and, indeed, to render its study possible: for, it is so vast and comprises such an immensity of facts and phenomena, that the mind is incapable of receiving and associating them, unless arranged in classes, so that the memory can retain the most important of them.

These divisions are made for the same purpose as the grander divisions of the entire of human knowledge into separate Sciences. And, here let me remind you that all are strictly artificial. Knowledge has no real or natural divisions; its parts are not separate, but links of one great chain. They are, even, less conceivably separate and disconnected than the substantial bodies of the Universe, (which also can have no separation or intervals between them) and constitute one continuous, uninterrupted circle. You mark it out into segments, the better to examine and become acquainted with it; just, as in the survey of any territory, you would mark it out into districts. Human knowledge, as regards its unity, is well represented by a tree, the roots, trunks and branches of which are without disconnection; and, in this relation you will do well to consider the different branches of the Science of

Organization, which is itself a larger branch of the great tree of Human Knowledge.

The first of these divisions is by far less arbitrary than any of the rest; because it has something of a foundation in nature. Organized Bodies are either Vegetable or Animal: and the primary division of the Science of Organization separates it into the Anatomy of the Vegetable, and the Anatomy of the Animal kingdom. (*Phytologia* and *Zoologia*). Subdivisions of a similar kind, but more artificial, are understood, when we limit our investigations to any particular class or species of animals: such are, the Anatomy of the Mammalia; the Anatomy of Man; the Anatomy of the Horse; each considered separately. Of a secondary and still more arbitrary kind are the sections made with reference to some object more particularly sought: as when we examine an animal or any class of animals for some special purpose. Thus, we have: its General Anatomy, which embraces the materials and sets of organs, more especially in reference to every thing they present generally; its Special Anatomy, which considers every individual organ; its Topographical or Surgical Anatomy, to which belongs the relative position of parts in the different regions of the body; its Pathological or Morbid Anatomy, which comprises all its morbid or anomalous changes. When the body of Man is known under all these aspects, and in different races, its Anatomy (*Anthropotomy*) is tolerably complete. The laws of its life, or of the actions of its different parts, constitute Human Physiology; which ought, as much as possible, to be studied with it. The aberrations of these actions, with the corresponding changes in the state of the organs, belong to the Healing Art; to the practice of which most of the branches of the Science of Organization are absolutely necessary, and all knowledge may be made available. Comparative Anatomy is that, in which the structure of the whole Animal kingdom is examined comparatively; each animal being compared to the rest. This is the highest and most extensive part of the Science of Organization; because it supposes a knowledge of all animals; and, so vast is it, that no one, that I am aware, has yet attempted to grasp at complete Comparative Anatomy: I mean, to comprehend in one work the Comparative Anatomy of all animals, in reference to the above-mentioned different points of view, under which the Human Body is studied. Indeed, Human Anatomy has not yet been presented exactly in so complete a form as it might be; and until that is

done, we can hardly expect it, for a work embracing the whole Animal kingdom. Blainville, however, has given a zoological classification, under which all the parts of it might be arranged, so as to make it complete; and he has furnished a vast deal of the materials for such a work. He divides the Science of animals, (or what I should term the complete Anatomy of animals;) that is, Zoology, or the Science of Organization limited to the animal kingdom, into:—Zooclassia, which has for its object the classing and naming of animals after their general external form, which, being known to represent the entire organism, admits of their arrangement in natural groups, and in such an order, that it gives, at once, the place each occupies in the Animal scale. Zootomia, to which belong the structure and composition of animals analysed by dissection; and which includes all that we commonly call Anatomy, when we specify it as the Anatomy of any particular animal or animals considered or not under any particular point of view, or as Comparative Anatomy, meaning a comparative examination of the structure of all animals. To be complete under this classification, I apprehend Zootomia must be General, Special and Topographical. Zoobiologia, which comprises the actions or functions of the different organs, and is commonly termed Physiology. Zooethica, or that branch of the Science in which the habits and destiny of animals are considered, and which we usually call Natural History. Zooiatria, which comprehends the anomalous alterations or morbid changes to which the different organs are liable; the manifestations of these changes in corresponding functional deviations, and the means of obviating them. This constitutes the Healing Art, and is evidently founded on, or results from all the other branches. Finally, he has gone one step further, perhaps too far, in ranging under the Science of Organization what he would call Zoonomia, or the art of managing and governing animals, so as to obtain from them the greatest possible amount of good. I say too far; because this would really include every branch of Human Knowledge.

It is not our province to consider Man under all the different aspects this classification indicates. I point them out, merely to show the nature and extent of the Science, and the uninterrupted continuity of all its branches; and, moreover, that you may know which are absolutely required for the Medical Art, and yet perceive how useful for its exercise are those which are generally considered less indispensable.

The Professor of Anatomy is compelled to limit his lectures, as much as possible, to the body of Man, considered, as I have stated, with regard to its General, Special and Topographical Anatomy; on account of the vastness of the subject, and the little time allowed for its pursuit. Still, as on the one hand, neither Physiology nor Morbid Anatomy is yet taught by distinct Professors; and, on the other, it is of the greatest importance these three immediately conjoined branches should be studied together; it will be our duty to include, in the view we take of the human body, its Physiology and the history of its morbid alterations: excluding all other branches of the Science of Organization when they are not directly useful to our purpose, but appealing to them whenever they are; and endeavouring to convey such a general notion of them as may induce and prepare you to extend your attention to them, on other occasions, when you have leisure.

In this lecture we have to take a view of Organization generally. As I hinted just now, Man, in his physical structure, is a part of the Organized World; and, to know well a part, we must have some understanding of the whole. To learn Man's, it is well to have an idea of all Organization; in order to ascertain (for such there are) general facts and laws applicable to his in particular, and which we can use advantageously in its investigation. If we discover these, which may be termed the principles of the Science, considered as a whole, we shall have the best possible foundation for our study, and the best means of extending it to the very utmost the time will allow. I think it must strike you, that to be well acquainted with any one of the class of Organized beings, it is of the greatest importance to have as good a conception as possible of them all. Minute details our time will limit to Man: but, we can scarcely hope to obtain these without knowing the general leading features of the whole Organized World; because, considered with regard to structure and composition, there is, I repeat, no absolute line of demarcation between one Organism* and another; they seem all to be formed upon the same general principles, and almost throughout of the same identical materials. Indeed, it has been maintained that Man is composed of divers inferior Organisms, or at least, that he passes through them *in utero:* but this is not strictly true; for, the analogy (other than that of general Organization) between the human fœtus at different stages of developement and certain

* The whole body, or assemblage of Organs.

animals, each more advanced stage corresponding to an animal more important and complex, is real only to an extent accounted for by the circumstances of uterine life. There is no metamorphosis. The belief that there is, must have sprung from the natural tendency men have to try to increase the interest of a favourite subject: but, surely, the facts observed in the growth of the fœtus are interesting enough to require no such forced interpretation,

The facts, and laws or principles of Organization, which I wish now to bring before you, as a foundation for your particular pursuit, will flow in natural order as we proceed to enquire into the nature of organisms generally. They are involved in the great question, which it is the first and chief object of this lecture to answer, namely:—What are Organized Beings?

The answer can be furnished only by comparison. We must seek it in a comparative enquiry. At first sight, this may seem a short and easy task. There appears, at first, to be no difficulty in distinguishing those bodies of the Universe which have life and organs from those which have not: there seems between them so wide and palpable a difference. The distinguishing characters of these Inert Substances on one side of the table, and of those Plants and Animals on the other, seem so glaring that you would not hesitate a moment to say to which Class almost any one of them belongs. But, this occurs only upon a superficial view. If you were asked to explain how they differ, and examined them minutely, you would find the task neither short nor simple; and, after the examination, you might be in great doubt where some of them ought to be placed; whether they belong to the Mineral, the Vegetable, or the Animal kingdom. There appears but little difference between this Coral and that Mineral, and who would believe, if the fact were not known, that this Sponge contained and was composed of a multitude of animals? The more closely we examine, the better conception we form of the nature of the three great Classes of Bodies; but it is a remarkable truth, that the farther we pursue the enquiry, the less real or essential differences do we find between them. Thus, Chemistry, (for I begin with their chemical composition, and first with the distinctive characters between Organized and Unorganized Bodies) which affords the minutest mode of positive analysis the human mind is capable of employing to detect their intimate nature, shews in them a much nearer resemblance than we could possibly have ima-

gined. It teaches us that the ultimate elements of Organized Bodies are found also in Unorganized bodies: that Oxygen, Hydrogen, Nitrogen, and Carbon, which almost alone compose and are the essential ultimate elements of the whole Vegetable and Animal kingdoms, do not constitute an absolute, distinctive difference between these and the Mineral world, because they all exist in the latter. It is true they are not in the same state: as, in the Mineral kingdom, Nitrogen is, probably, always, in combination so as to form Ammonia; and in the Atmosphere, (which we may with propriety consider, as Blainville does, one of the substances common to and pervading all matter, Water being the other) it is, at least, in mixture with other elastic fluids. Carbon, too, is scarcely ever found there, except in combination with Oxygen, and through it, with other elements, as in this Carbonate of Lime.

The aggregate number of ultimate elements in all, and the particular number combined in each of the Bodies of the three kingdoms; their state of combination; the kind of matter they constitute, or intimate structure; and the external form, mode of origin, growth and decay of these Bodies themselves, will afford us, by contrast, the best possible knowledge of the nature of Organized Beings.

In these last, taken aggregately, the number of ultimate or simple elements is very small; they are only Oxygen, Hydrogen, Nitrogen, and Carbon, (which four may, perhaps, be considered their essential elements) Sulphur, Phosphorus, and one or two others, (probably rather adventitious than essential:) whereas, all these, and upwards of forty more exist in the Unorganized kingdom. The combination of elements in the latter is often only binary, and, at most, ternary. This Flint, like many other Bodies on the surface of the earth, is composed of only two elements—Oxygen and Silicium, and this Magnesite of three—Oxygen, Magnesium, and Carbon; and, the mode of combination is such, that the combustible elements are completely saturated with Oxygen: In other words, they are completely burnt, and all have yielded to the strongest possible affinity which could operate on them; hence, the difficulty of disuniting them, or the solidity and resistance to decomposition of Unorganized Bodies. In Organized Bodies, on the contrary, the combinations are scarcely ever less than ternary or quarternary; and here, from the sum of affinity, if I may so express it, being divided among a greater number of elements, and from the combustible ones being less saturated with Oxygen, we find

beautifully explained their facility of decomposition: The enormous difference in respect to solidity and durability between this muscle or portion of flesh, and that piece of marble is thus satisfactorily accounted for.

The intimate disposition of the matter or substance constituted by the union of ultimate elements is very different in the two classes of Bodies: in the one—the Unorganized—it may be perfectly homogeneous and entirely formed of solid particles: but, in the other class—in this Orange or this Bone—the three forms of matter, gazeous, solid and liquid, must co-exist; and the disposition of it is such, that it shapes itself to a kind of cellular arrangement or tissue which admits of whatever modifications may be necessary to form organs or parts more or less heterogeneous. This spongy or permeable arrangement of matter, in the areolæ of which new molecules can penetrate, is one great characteristic of Plants and Animals.

With regard to external form, it may be averred that the latter never present a perfectly straight surface; in one direction, at least, they are always rounded or curved: there is nothing straight or stiff in Living Nature; but the Mineral Molecule is always limited by straight surfaces.

But, the mode of growth or increase is, certainly, one of the most remarkable and distinguishing features of Organization. As was stated just now, the Mineral Molecule, once formed, admits of no growth; it is decidedly dead. Minerals do increase; but, the mode of augmentation is altogether opposed to that by which Organized Beings grow. In the former, the increase is by layers or plates; and *each Molecule* is a *Complete Mineral:* whereas, in the latter, it is absolutely by nutrition; fresh substance penetrating *their very substance.* In the one case, the increase is by super-position, by the attraction of the *whole body* or Mineral, externally; in the other, it is by intus-susception or absorption of *particles* internally. There is no Organized Being, of each Molecule of which you can say, it is a complete Plant or Animal. This, in my opinion, is the leading feature of Organized Bodies, shews best their intimate nature, and constitutes their most distinctive character.

Again, the limits to growth are definitely prescribed to Organized Beings; whilst, in the other Class, the increase taking place by the simple laws of ordinary attraction, Mineral masses go on augmenting indefinitely, in a manner more or less irregular and accidental. There

is, however, a kind of approximation of the two Classes, as far as regards real Minerals; which do increase within certain limits and under an aggregate of circumstances more or less appreciable: and, what is still more remarkable, we can explain by simple laws how a primary form of Molecule has arrived at a secondary one. We observe, too, the striking fact, that each variety appears to depend on external, local circumstances, perhaps more than the varieties of the Organized World; so that we can say of a crystal, as we can of an animal: it belongs to such and such a locality.

Origin by generation is said to belong only to Organized Beings, and constitutes a character which has been much dwelt upon as eminently distinctive. In their formation, we find that certain component elements are brought into contact and union; and that a new being is originated by the more or less necessary exercise of the functions, by the natural processes of life in the parent: Whereas, in the Unorganized World, individuals in their succession are quite independent of each other. Still, there is a kind of analogy between the two, as far as regards the Molecule, considered as the body, which Blainville has beautifully explained. We suppose the Mineral compound Molecule to be a combination of determinate composing Molecules, assuming a form equally determinate. Now, at the moment the component Molecules act upon each other by reciprocal affinity, and so dispose themselves as to constitute the new compound Molecule, there really is something like generation. Of course, this does not apply to the Crystal, or to any thing beyond the mere Molecule: and the process, which approaches in some degree to a living one, is limited to the extremely short instant of formation; the very moment after the Molecule is formed, it is utterly inert, devoid of the least trace of life.

Characters equally striking and distinctive are manifest in the mode of decrease or decay, which we term death, and which, in truth, is a chemical decomposition. Unorganized bodies are diminished and destroyed by external forces acting upon them physically, mechanically and chemically: they decrease, therefore, from without, inwards; because, on their exterior external circumstances chiefly act; and their elements, when caused to separate, go to form new combinations, and never reproduce the same being. Besides, their elements are so fixed and immoveable, or held together by an attraction or affinity so

powerful and permanent, that some Crystals absolutely evince a tendency to last for ever. How different is it with Organized Bodies! they are all transient; they decay by internal change, by alteration in the substance of their organs: and, at some time or other of their existence, or at death, their elements are employed to constitute new beings, images of themselves. These data, Blainville, whom, in this exposition, I could not do better than follow, embodies in his admirable definition of an Organized Being. He defines it, in contradistinction to an Unorganized one, a moveable combination of a certain number of elements; having a cellular structure; assuming a more or less round form; taking its somewhat spontaneous origin from a like being; growing by absorption; decaying by a kind of exhalation; (the internal decay he supposes to occur by a sort of exhalation) and perpetuating its likeness in time and space; inasmuch, as certain of its elements do, by combination under particular circumstances, produce a new being like itself. With this model you can easily construct the definition of an Unorganized Body. It would be a fixed combination of a smaller number of elements; having an homogeneous structure; assuming a geometrically straight form; originating not from a similar body; itself increasing not, but being in aggregation with like bodies added by super-position; possessing a tendency to permanency; and, when decomposed, (which may happen from external influence,) producing not another like itself.

Our inquiry into the nature of the different Bodies of the Universe, thus far pursued, has enabled us, then, to learn, to a certain extent, what Organized Beings are; in fact, to distinguish and to define them. By carrying it still farther, our knowledge of them will become proportionately more complete and satisfactory. We shall find, that some of them are endowed with motion much more extensive, and much less immediately depending on external circumstances than others; and, yet, that they evince the faculty of feeling these circumstances. They constitute the Animal Kingdom: the others are Vegetables. An examination of the differences between these two classes of Living Beings will furnish us with the other numerous facts or data necessary for the completest possible understanding of the nature of Organized Beings, and of Man, who, although raised above them all, is still, in physical structure, one of them: and, therefore, necessary to the Anthropotomist; because, I repeat, they give the principles, and

form the foundation of his as well as of every other department of the Science of Organization.

We begin, as before, with the ultimate chemical elements. Of those which may be called essential, (in contradistinction to those which are evidently subordinate and more or less adventitious and accidental, and therefore less characteristic of Organized Beings,) we find none exclusively confined to one or other kingdom; still, Nitrogen is the great prevalent and distinguishing element of Animals, and Carbon that of Vegetables. Of the adventitious elements, we observe Phosphorus to be very nearly confined to Animals; and Lime to be extremely prevalent in them, forming chiefly their most solid parts, as Carbon does those of Vegetables: whilst the Alkalis, Soda, Potash, and Ammonia, and two or three of the metals, such as Iron and Manganese, are common to both. Ammonia, however, is of course, by far, most prevalent in Animals.

The next step leads us to the immediate or compound elements, which afford some marked characters. Of those composed of three ultimate elements, which are Acids, (Oxygen being in excess) there are but three common to Vegetables and Animals,—the Acetic, the Oxalic and the Delphinic; and but three which exist in the Animal Kingdom and they are derived from fat substances—the Sebaic, Oleic, and Margaric: all the rest of the compound elements or acids of this kind belong to the Vegetable kingdom.

To the latter belong all those of the compound elements called Neutral Substances, composed of three ultimate elements, Oxygen, Hydrogen, and Carbon, and in which the two first are in the proportion to form water, such are Gum, Sugar, &c.; whilst, similar substances (Neutral) in the Animal kingdom, contain one more element, and that element is Nitrogen. The numerous alkalis composed of the same three ultimate elements, such as Morphine, Quinine, are found only in the Vegetable Kingdom; and, therefore, constitute one of its features. If we go to the next kind of immediate principles, those in which Hydrogen is in excess, we discover something like analogy: Camphor and certain Vegetable Oils and Balsams resemble the Fat and Oils of Animals. The sole immediate principle composed of the three elements, Hydrogen, Nitrogen, and Carbon, which is acid, (the Prussic) exists ready formed only in vegetables; but, the decomposition

of animal substances easily produces it; so that it can scarcely be said to be peculiar to either.

Acids composed of the four elements, Oxygen, Hydrogen, Nitrogen, and Carbon, as the Amnic and Uric, are strictly confined to the Animal kingdom. But, these four elements constitute neutral principles in both this and the Vegetable world: in the former, such are Fibrine, Albumen, Gelatine; and in the latter, Gluten, Indigo, &c. This fact, I believe, we owe to Mr. Chevreul.

Thus, Gentlemen, you perceive, upon the whole, the prevalence of Nitrogen to be, perhaps, the most distinguishing feature in the composition of animals; and, as, also, quaternary combinations, or immediate principles composed of four ultimate elements, are far more frequent in them than in Vegetables, (in which the immediate principles are almost always ternary or composed of only three,) decomposition takes place in them with proportionately greater promptness and rapidity: the tendency in substances to a separation of their elements, being in general, in proportion to the number of these they contain.

We come now to the intimate structure, or mechanical disposition of the materials which have been described. In animals, generally, you will find they are arranged in one or more tissues, constituting by certain modifications, systems, or sets of parts, with like general characters, and among other organs, complete tubes in which the fluids circulate. This is not the case with vegetables generally, although there may be some appearance of rudimentary tissues in a few of them: as, on the other hand, in some animals, the homogeneity of their substance is such, that neither these nor vessels can be discerned.

With regard to general form, you will observe that animals are almost universally disposed in two symmetrical halves. Look at any of the animals on the table, at this Lobster for instance, and see how perfectly symmetrical are its two lateral halves; how exactly the parts on the right side resemble those on the left, supposing it to be divided on the median line. Compare this disposition with any plant you please, and the contrast will be striking. In the Vegetable Kingdom, the general form is radiating or ramifying. Still, there is an approximation to this in some inferior animals, in the star fish, for example: and, as some parts of Vegetables are decidedly symmetrical,

the point of union between the stem and the roots of plants, (collet) has been compared to the median line of animals; but, it certainly does not divide them into two exactly similar halves. The singleness or individuality of Animals accords with their form, and serves to distinguish them; for, it is only at the bottom of the scale, that we find them at all like a vast portion of vegetables, which are compound, a certain member of individuals being decidedly continuous.

The next character of Animals, on which I desire more particularly to fix your attention, is their mode of nourishment. In considering it, you will observe a striking and beautiful contrast between the two kingdoms; and in each, an exact and admirable conformity between the Beings and their destiny; between the material structure and the functions, which are as closely linked as cause and effect can be. Vegetables absorb their nutriment by an external, Animals by an internal surface: absorption is performed by the roots and leaves in the one case, by the alimentary canal in the other. Both may be said to have two absorbing surfaces. In Plants, the leaves which float in the air represent one; the roots sunk in the earth, the other; and these and their vessels meet end to end at the collet. In Animals, the external skin constitutes one surface; its continuation or prolongation into their centre, in the form of an internal reservoir, the other; and their place of meeting is the mouth or the point where one begins to be turned or doubled into the other. Hence, the distinguishing privilege possessed by Animals of moving from place to place; since they can contain and carry with them their food: while vegetables, compelled to keep their two absorbing surfaces in a fixed position, one in the earth the other in the air, are of necessity stationary beings. Agreeably to this disposition, we find, that in animals, the food, before it affords nutriment, is acted upon by the internal skin or stomach; that nutriment is therein extracted from it, after a preparatory process termed digestion. In Vegetables, on the contrary, there is no such preparation of the food; immediate nutriment being directly taken in from the earth and the air. Probably, it circulates afterwards, or at any rate begins to circulate, by the same kind of resident force, in both; although, in the latter, it has been termed capillarity, and in the former irritability: and, assimilation, or the process by which the new matter becomes changed into the substance of the

plant or animal, making part and parcel of *their* intimate substance, is no doubt performed, in both, through the same influence, which, in our judgment, closely approaches to Chemical affinity—an affinity perhaps stronger in vegetables, since, of the two kinds of beings, they offer the greater resistance to decomposition.

In respiration, Animals absorb Oxygen, and emit Carbon: Vegetables, on the contrary, seem, after absorbing Carbonic acid, to exhale the Oxygen, and to retain the Carbon. I say seem, because we have proof of their inhaling it only in their green parts, and that under the direct influence of the Sun's rays; but, if it were absolutely true, we should have a character whereby to distinguish, at once, the two, kingdoms.

The Mode of Growth is very similar in Animals and Vegetables. Both grow by their extremities first increasing in length, and then in other diameters, in all living parts: the unliving ones, as we have had occasion to observe, increase, by mere deposit, like Minerals; except, that in the latter, the new matter is superadded externally, and in the former internally. The nails, for instance, grow by new matter deposited at their inner surface. The Mode of Decrease or Decay is very much the same in the two kingdoms; and the processes, by which they are, as it were, taken to pieces, Blainville considers to depend on a kind of exhalation of matter. That wonderful function by which the Species is preserved, more or less at the sacrifice of the Parent Individual, and which, in recomposing the new being, evidently decomposes in some measure, the old one, is essentially of the same kind; and even, in the particularities of the organs executing it, there are some remarkable coincidences.

Finally, Gentlemen, I have to call your attention to the existence, in the Animal kingdom, of two substances which cannot be detected in the Vegetable world—the Nervous matter and the Muscular fibre. To these they owe sensation and motion; to these they owe the high faculties of feeling external influences, and of moving more or less independently of them, that is, with a certain degree of spontaneousness or voluntariness, so as to avoid what is deleterious and approach what is useful. Where you find these potent materials, you may be sure there is Sensation and Motion; you may be sure you have to do with an animal. Still, even here, nature's great rule of gradual modification

has not been departed from. These tissues, I dare say, do not begin abruptly in the series of Organized Beings: for, certainly, the functions they execute do not. We know that there are some Beings both Animal and Vegetable, possessing spontaneity of motion, in which they cannot be detected. Although, then, the Muscular and Nervous substances are the great characteristics of animals, since in them alone they palpably exist, the old and supposedly obvious distinction between the two kingdoms afforded by sensation and motion, is good only in degree. Vegetables evidently evince the want or destiny of reproduction in their generating organs; and, as many of the lowest animals appear to enjoy voluntary motion—to move, in some of their parts, to or from bodies, according as they are beneficial or injurious—and, yet, have neither nerves nor muscles apparent to us, we cannot deny a sort of approximation, even in these great functions. It is right to observe here, that, in general, the kind of motion of which Vegetables possess the power, hardly deserves that name; for, it is executed by the direction of new parts as they grow, and not as in all animals, by a sudden change of place of their entire or of some particular part.

This terminates our inquiry into the nature of Organized Bodies. These are the chief facts which enable us to answer, as far as the present state of Science allows, the question proposed at the beginning of this lecture: namely, what are Organized Beings? Blainville, with his usual ingenuity, has endeavoured to sum up the most important of them in distinctive definitions, of which you now know the constituents, and which I think it would be difficult to improve without lengthening them to an inconvenient extent. He defines a Vegetable to be:--an Organized Body, strongly Carbonized; capable of nourishing and reproducing itself; most frequently compound; without intestinal canal; without muscular or nervous matter; and, consequently, digesting not; moving not; feeling not its relations with external bodies, although it may sometimes appear to feel them, by the slow and gradual changes we see it offer for a determinate end. He defines an Animal, on the contrary, to be:—an Organized Body, strongly Nitrogenized; almost always simple; always possessing an alimentary canal; and, probably, always, nervous and muscular fibres, which are most frequently visible; consequently, digesting its food; feeling more or less its relations with external bodies; and showing that it does

feel them, by the sudden motions we see it execute for a determinate purpose.

We now approach the second object of our Lecture,—the fundamental facts which belong to the structure of the Human Organism. To this the first has been, we repeat, a necessary preliminary. As you advance in the study, you will feel, more and more, the value of the facts we have ascertained. They establish the truth of a direct and constant relation between the elements of the human body and those of the rest of the Universe; the latter constantly influencing the former, and the former incessantly re-acting upon the latter: and, in this point of view alone, they are pregnant with important deductions and results, particularly as regards the preservation and restoration of health. They constitute, in fact, the true basis of the Medical Art, as well as that of the Science of Organization.

It is our business to endeavour to become acquainted with the Human Body by every means in our power, and more especially, by taking it to pieces. In addition to the preceding facts, we should bring to the examination all the other information we can obtain: knowledge, speaking generally, is a means of acquiring knowledge; and the more we possess the more we can acquire. This applies more forcibly to cognate branches of it; which, therefore, should be studied, as much as possible, at the same time: they go hand in hand and should be pursued together. However, this, of course, may be carried too far; but, to a reasonable extent, it is of great importance the medical pupil should blend those pursuits which throw light upon each other. Our chief duty here is to study the body mechanically by dissection. We ought also to investigate its intimate nature by Chemistry; to apply to its examination the principles of Natural Philosophy, in considering the influences exercised on it by other bodies of the universe; to observe it, during life, under the greatest possible number of circumstances of health and disease; to bring to its study the knowledge derived from experiments upon living animals, made, of course, with the utmost caution to avoid pain, and therefore scarcely ever beyond the extent foreseen, *à priori*, to be useful for the ascertaining of any facts: and all this should be done in reference, as much as possible, to the races and varieties of Man; his position on the earth; his age, or period of developement and decline. This catalogue shows, we ought to embrace, at once, as many branches (especially neighbouring

branches) of Science as possible; since we see how all are more or less essential to each, and each to all; and that the more of them the human mind can fairly grasp, the better must it understand each.

We should examine the human body, almost in the same manner, the engineer examines a machine he wishes to become perfectly acquainted with. He must know its concurring parts (organs or instruments;) their form; relation; mode of connexion; the materials of these and their properties; the action of each part; the changes to which it may be liable; the influences it may be subject to from without or within. He, therefore, besides taking it to pieces, observes it with or without experiment, in or out of action natural and unnatural. He does more than can be accomplished for the living machine; he puts it together again: that is, he proceeds synthetically as well as analytically. We cannot do this, but, still, we can, in some respects, proceed synthetically from certain data taken *à priori*, as I shall presently shew.

In proceeding analytically, we cannot do better than adopt the rules for examining organs laid down by Béclard in his *Anatomie Générale*. The Anatomist has to consider in each:—1stly. Its general form; 2ndly. its general situation, and relative position with regard to other parts; 3rdly, its direction; 4thly. its general and relative volume; 5thly. its physical state as regards density, cohesion, elasticity, colour, transparency; 6thly. its physical composition and texture, or the Arrangement of its Constituents; 7thly. its Chemical properties and composition; 8thly. the Fluids it contains; 9thly. The properties it possesses during life; 10thly. its action during life, and the relation and connection of this action with the actions of other organs; 11thly. the varieties it presents with respect to age, sex, race, and the individual; 12thly. its Morbid states; 13thly. its post-mortem changes and phenomena. This, Gentlemen is a complete Table of the Interrogatories to which we shall have to subject all the Organs of the Body. What these Organs are; and how they may be arranged or classed, is the next point, to which I now desire to call your attention.

The name of Organ may be given to any distinct part of the body, however simple, or however complex, provided it be in a solid state. Thus, the muscular fibre, which is one of the three simple solids into which all the others are resolvable, may be considered as the Organ of motion generally; just, as we term the lungs, which are very com-

plex, the Organs of Respiration. It is better, however, to call the three simple solids which compose all the rest, *the Anatomical materials of Organs, or Primary Anatomical Elements,* rather than Organs. As we say the Organs are the solid parts, you foresee, no doubt, that there are other parts not solid. So it is. These last, Anatomists range under the generic term of Fluids. They are either liquid or gaseous. Blainville, however, considers some of them as semi-liquids.

I must now tell you what we ought to understand by Solids and Fluids. This has never been sufficiently explained: I may say, indeed, incorrect notions are prevalent on this subject, which have given rise to so many false systems of Medicine, and are still an abundant source of Pathological errors.

The body is spoken of, as if it were really divisible into Solids and Fluids; and the proportion of the latter to the former is said to be as nine to one. But, the fact is; it is not divisible into Solids and Fluids without a total alteration in their properties: and, when authors indicate the proportion they bear to each other, all they ought to mean is, that when a body is dried and mummified, it loses nine-tenths of its weight, one tenth remaining in a solid state. Now, this tenth which remains, is composed of solids; but they are mightily changed: the muscle, bone, membranes, and different parts have no longer any of the physical properties they possess in the living body, or shortly after death. They may not be altogether destroyed in Chemical composition; they may not have entirely changed; but they have scarcely any resemblance to what they were. Let it then be clearly understood, that when we speak of Solids and Fluids distinctly, as they exist in the body; all that we mean by Solids is, the Solids separate from all the Fluids, except those necessary for the preservation of their properties, as possessed in life or at death; and by Fluids, such portions of these as are free, and can be removed without alteration of the Solids. Thus, when we speak of the blood, we mean that portion only which is free, and circulates in the vessels; and not every particle of blood retained in the different Organs and about to nourish them. And when we speak of the muscular fibre, as a Solid, we do not mean a a muscular fibre deprived of all moisture, but as it exists in the body, containing the Fluid necessary for its form and properties. The Fluids and Solids, thus understood, cannot be separated and measured after death,

because we have no means of removing or estimating the precise quantity of the former, which may be removed without materially altering the latter; and, during life, the solid parts are constantly changing into fluid ones, and the fluid parts into solids. Very frequently they are only different states of the same parts, which are constantly changing from one state to the other. What is solid one instant may be fluid the next; and what is fluid one instant may become solid the next: as the fibrinous globules now opposite my finger, in the vessel of this living animal, in a liquid state, may become a solid part of one of its muscles, without any material change in its chemical properties, in a shorter time than it takes to announce the fact. Solids and Fluids are, then, rather relative than absolute terms, when we speak of the parts or Anatomical constituents of the body, as they exist during life or shortly after death.

As I stated just now, the solid parts (that is, the Solids imbibing the quantity of fluid necessary for them) are named the Organs. In taking the body to pieces, we find these parts to be numerous Bones, Muscles, Membranes, Nerves, &c. These are the Organs. The Anatomist has to study each Bone, each Muscle, and each of all other Organs in particular; but, as each of them has certain general characters which belong to all Organs of the same kind, it has been found advantageous to study them also in sets or classes, which are technically called *Systems of Organs.*

Thus, as each Muscle presents certain Characters common to all Muscles, these have been united and studied together as the Muscular System: and, the same has been done for all other Organs sufficiently similar to be united in a group. All that relates to Organs, thus considered, has been designated General Anatomy. Bichat, who was the greatest if not the first General Anatomist, made out no less than twenty-one Systems; each System being an assemblage of similar Organs, or Organs of the same kind: and well has his admirable Treatise shown the advantage of studying systems as well as each Organ in particular. Since his time, their number has been reduced nearly one half; because, he sometimes divided into two, a system which had better have been left undivided; the two not being sufficiently different to constitute separate systems. Similarities have been discovered which he did not perceive; and it does not detract from

the merit of this great man, that he formed more distinct groups or Systems than there really are.

You understand, then, that all the Bones constitute the Osseous System, all the Muscles the Muscular System, all the Serous Membranes the Serous System, and so on ; and, that into these Systems or sets of Organs the body is immediately resolvable: or, synthetically speaking ; put together, in their places, these sets of Organs, and you form the Human Body. Now, Gentlemen, pursue the Analysis a little farther, and ask what these Systems are composed of? The answer will astonish you. Only three distinct, solid, Anatomical Materials compose the whole of them. In the most complex of them you will find employed no more than these three ; and, in the most simple, only one. To view the body in its complex machinery, to examine the wonderful machine in its vast and varied actions, it seems impossible that it should be made of only three solid materials; but so it is: the cellular substance, the muscular fibre, the nervous matter; these three simple elements compose the multifarious Organs, make up every solid part of the body. When they are called Elements, it is necessary to distinguish them from the Chemical Elements by the epithet Anatomical. By Chemical Elements, we understand the substances into which the body may be resolved by Chemical analysis ; and by Anatomical Elements, the minutest and latest distinct parts into which it may be decomposed by mechanical dissection. Still, it is but just, to say, that, in order to reduce it to these last, we are often obliged to employ something like chemical means. The Chemical Elements, as you know, are either immediate, such as Fibrine Albumen, &c., which we often call immediate principles, because the body is revolvable into them by very simple and direct chemical processes; or ultimate, such as Oxygen, Hydrogen, &c., which result from an analysis carried to the farthest possible extent. The three Anatomical Elements will be particularly described in the succeeding lectures, still I ought here to give you an idea of them.

The cellular substance, which alone forms so many Organs, is, from its very simplicity, difficult to describe. Nothing gives so good an idea of it as ocular inspection. As I separate two bundles of fibres in this muscle, you perceive a kind of web which becomes apparent and forms itself into cells, as they are gradually drawn asunder, and then entirely gives way; leaving scarcely any thing apparent, or no-

thing more than a thin layer, which can be perceived only when you raise it up with the point of a fine instrument from the muscular fibres it covers, and between which it was interposed, in the shape of a layer so thin as to be scarcely perceptible. In fact, it seems to exist as a kind of glutinous medium, in which all the parts of the body are imbedded and connected. In many places, it evidently forms cells: such are those which contain the fat, the marrow, and the serous fluid moistening the cellular substance generally. This is the universal element of the Animal kingdom: it enters into the composition of all Animals in a similar manner; and a substance like it in mechanical arrangement, constitutes the woof, and fulfils similar purposes in all Vegetables. Hence it is, as we have stated, a striking and distinguishing feature of the Organized World. You will find, that on the one hand, it serves to includeand connect all the Organs of the body; and on the other, that it is employed to compose their substance. Indeed, the greater number of the Organs of the body are made up chiefly of cellular substance more or less modified; and none, in my opinion, are entirely without it: so that if it were possible to remove every particle of the body, except the cellular substance, and to leave this undisturbed, it would represent the body's mould with innumerable cells, tubes, and vacuities; in short, a sort of sponge, of the same form as the body, with spaces, cells, or cavities, in which every other part, solid or fluid, is set and contained. Its most striking properties are elasticity, extensibility, and hygrometricity. The first enables parts to move and glide upon each other without laceration, as when you pinch up a fold of skin; and, certainly, the faculty it gives parts to accommodate themselves to the multifarious motions or changes of position they are constantly undergoing, is one of its most remarkable functions. From its hygrometricity it sucks up fluids like a sponge, and allows them to pass into it by imbition. This Universal Element of animals appears to be formed, almost entirely of Gelatine; which is itself composed of Oxygen 27·207; Hydrogen 7·914; Carbon 47·881; Nitrogen 16·998; or according to Mr. Chevreul, who considers Gelatine to be a mere modification of Albumen, of Oxygen 23·872; Hydrogen 7·540; Carbon 52·883; Nitrogen 15·705. From the arrangement of this substance, it is often called Cellular Tissue; and the term tissue is often extended to the two other simple, solid materials: but, as it is also used to denote the *substance* of a System of Organs, or of a Com-

plex Organ in its collective composition, (as when we say the Serous Tissue, the Tissue of the lungs,) it is necessary to designate these three materials as *elementary*, *primary*, or *generating* Tissues, if we call them Tissues at all.

The second Anatomical Element is the Muscular Fibre, which possesses the wonderful power of contracting or shortening, either at the will of the individual, or by some other stimulant. You know it well by sight and taste; it forms the muscles or red parts of the meat at your tables. It seems always in the shape of cords. Examine minutely any piece of flesh or muscle you please, and you will find that it consists of fibres, fibrils, or little red cords, united by cellular tissue: and each of these, viewed with a microscope, has the appearance of a series of globules. Blainville, however, denies that the muscular fibre is a linear series of globules. He considers the globular appearance to be an optical illusion: but, taking them to be globules, are they exactly the same as those of the blood? The chemical composition of the fibre seems to indicate it. It is formed almost entirely of Fibrine, and therefore of Oxygen 19·685, Hydrogen 7·021, Nitrogen 19·934, Carbon 53·360; but it contains also Osmazome, and perhaps Hematosine.

The third, or last, solid Anatomical Element is the Nervous Matters. You see here a kind of pulp: it is the brain of a Sheep. As I cut it through, you observe it to be white in one part, greyish in another; and this difference of colour probably indicates some difference in the substance. But, we consider it all as essentially the same, and call it Nervous Matter; because the nerves and the nervous ganglions, the brain, &c. are made of it. It exists, either in the form of a pulp, as you see it here, or of cords as you perceive it in the nerves. In the latter case, it is enveloped with cellular substance sufficiently strong to form a sheath to each fibril in the cord; in the former, the cellular substance is so fine, that we judge of its existence only by analogy. This nervous matter, examined with a microscope, seems also to be globular; but, Blainville considers it rather as granular, or as an assemblage of grains, or corpusculi, rather than of globules. According to Vanquelin, it consists of Water 80·000; Albumen 7·00; a white Oily Matter 4·53; a red Oily Matter 0·70; Osmazome 1·12; Phosphorus 1·50; Sulphur 5·15; with traces of Phosphate of Lime and Magnesia; Phosphate of Potash and Chlorine of Sodium: that is of Oxygen, Hydrogen, Ni-

trogen, and Carbon, as essential elements; of Phosphorus, Sulphur, and a small proportion of salts as accessory ones.

With these three materials or Elementary Tissues, of which the two last, conferring sensation and motion, are peculiar to animals, you will conceive, at once, how the different Systems are made. The Cellular Element, alone, as we have pointed it out to you, taken as a whole, constitutes a System, and is called the *Cellular System.* Condense the Cellular Substance into a very thin membrane, disposed as a pouch or bag, and you have the Serous and Synovial Systems: condense it less, and modify it so that it offers follicles, and it gives you the Mucous Membranes, or the Mucous and Cutaneous systems: take it in a larger quantity, and still, condense it firmly, and it forms the Fibrous System, or all the fibrous parts of the body: give it another arrangement, and you find it constitutes the Cartilaginous and Fibro-cartilaginous Systems: add to this the earthy salts or the requisite accessory elements—charge it with Phosphate of Lime—and you have the Bones or Osseous system: dispose it so as to make tubes, and it furnishes the Lymphatic system: Add to these tubes a little of the second element, or Muscular Fibre, and the Arterial and Venous systems are constructed.

Now, take the second element, the muscular fibre: multiply it; add to it the proper sheath of cellular element; then dispose it as a canal, and you have the sub-mucous muscular system: multiply it still more, and join with it the due quantity of cellular substance, and the Voluntary System of muscles is composed.

Thirdly. Employ the nervous matter. Let it be collected in a pulpy mass, with an extremely minute quantity of cellular substance, and you have the Cerebrum, Cerebellum, and Spinal Marrow: add more of the cellular element, and you produce the nervous ganglions of the viscera: let it be disposed in cords, each cord surrounded with the cellular element in the shape of a sheath, and it makes the Nerves.

Thus, gentlemen, what appears complex and difficult when presented in an insulated and immethodical manner, becomes simple and easy in the extreme when viewed scientifically.

Having explained to you what are the three solid, Anatomical Elements of the Body, and how they compose all the solid parts or organs, and System of Organs, I must add a word or two respecting the fluids. I have already mentioned that the two are inseparable; that the solids as we have described them, are always imbibed with a certain quantity

of the fluids and contain them all; so that if you remove all the latter by artificial means, the former cease to be what we have described them, and become quite another thing, except that they may retain their characteristic chemical element: the Cellular Substance will still be Gelatine; the dried muscular fibre will still be fibrine; and the Nervous Matter may still preserve some of its characters: but they will cease to be any thing like what we find them constituting the body. I repeat, however, most of the fluids may be removed in a certain quantity, without materially interfering with the solids: only, recollect, that when we speak of the fluids considered apart, we do not mean all that can be obtained or extracted from it in a fluid state; but, merely, that part of what exists in the body in this state, which may be removed without material alteration of the solids.

The fluids may be divided into those which are chiefly concerned in nourishing the body; and those which are secreted to serve some purpose not immediately nutritive. The first are few in number, and form the general circulating fluid; and, therefore, deserve more to be considered as elements or constituent parts of the body than the others; which are very numerous, less permanent, local, some of them serving local purposes, and some being mere excretions, destined to be expelled chiefly for the purpose of depuration. Still, even these are parts of the body, at the time of formation, and until the moment they are separated from it. The first class comprises the blood; the chyle; the lymph; and the atmospheric air entering the lungs. The second class comprises the fluids secreted in different parts of the body; such as the tears, saliva, milk, bile, &c. All the fluids will be described to you in regular order as we proceed in the course: but, I should mention here, that there is some difference of opinion, among Anatomists, as to those parts which ought really to be considered as fluids; and that we are not exactly agreed about the number of those in a gaseous state. Blainville considers that the Nervous Matter, which we have described as one of the three primary Anatomical solids, is a fluid which he calls *Neurine;* and that it assumes a solid form only from its combination with the Cellular Substance, as I mentioned. He also considers some parts of the body as Semi-liquids; namely, the fat, the bulbs of the teeth and hair, and, with some doubt, the matter of the *corpus luteum.*

You see, now, Gentlemen, what are the Anatomical Elements which

compose the organs of the body; how, out of only three, in a solid state, alone or combined, and always imbibing more or less fluid, the different Systems are made. We find that Oxygen, Hydrogen, Nitrogen and Carbon, forming as they do Albumen, Fibrine, and all the other immediate principles or immediate Chemical elements, are the essential, ultimate Chemical elements of these Anatomical elements, and of all the Fluids: and, therefore, compose the Human Body as they compose all other Animal Bodies; the other ultimate elements, such as Sulphur, Phosphorus, &c. being less essential. In other words, these ultimate Elements compose the three primary solids (the Cellular Substance, the Muscular Fibre, the Nervous Matter) and all the fluids. The three solids with the fluids compose all the organs, (which we unite in Systems,) and the assemblage of these constitute the Human Body.

Before concluding this part of the subject, I ought to mention to you, that Physiologists are not all agreed about the number of solid Anatomical Elements to which the organs may be reduced. Meckel carries the mechanical analysis farther than we have done; and holds that the whole body, Solids and Fluids, are resolvable into two Anatomical Elements—Globules and a Matter which he calls Coagulable, and which is sometimes coagulated, sometimes fluid. The Globules never exist alone; they are always united to the coagulated matter, whether in the Solids or Fluids. United in a linear series by the second element, then in a coagulated state, they constitute the Nervous Matter and Muscular Fibre; and swimming in the same element, then in a fluid state, they constitute the blood. The Coagulable Matter may exist alone; it alone forms the cellular tissue, and the numerous systems which this composes. In other words, Gentlemen, Meckel makes out that the Nervous Matter and the Muscular Fibre we admit as primary Anatomical elements, are composed of Globules and Coagulable matter; and that our third element, the Cellular Substance, is this matter: so that, in reality, the difference between us is not great. We prefer the view we have taken, because it is not yet sufficiently demonstrated, that the Muscular Fibre and the Nervous Matter are really composed of Globules.

I take this occasion to mention that some Anatomists admit a fourth solid element which they call the Corneous or Horny Substance, and which composes the cuticle, nails and hair; but these, as I have

already stated, are mere depositions and not Organized : they really have not life, and partake of it only inasmuch as they are united to living parts ; and, moreover, they seem to be formed of a matter secreted and deposited liquid, of a gelatinous nature, probably differing but little from the Cellular Substance, and which becomes solid afterwards. It is a part of the body, if you will ; but of a very secondary importance, and must be ranged in the same line as some of the products or secretions, rather than with the generating Anatomical Elements.

I ought, also, to say something, here, on the Substance of complex organs ; and complex they all are, except the three Anatomical Elements : that is, they are all formed of more than one of the three, and often of several of the Systems which these compose. The different Systems, often called tissues when spoken of as component parts of a complex organ, are generally distinct in some parts of such an organ ; but, in others they are so blended as not to be susceptible of separation ; and, where they are so blended or combined, they form what is generally called its *proper* substance, tissue, or parenchyma. The lung, for instance, has its air tubes, formed of a mucous membrane (Mucous System) ; of contractile fibres (Muscular System) ; of fibrous membrane (Fibrous System) ; of cartilage (Cartilaginous System) : they have the three orders of vessels (Arterial, Venous and Lymphatic Systems) ; they have nerves (Nervous System) ; and all these are held together by common cellular substance (Cellular System). Now, these may be distinctly seen in certain parts of the lung ; but we cannot follow them all in every part of it. They evidently become less and less distinct, more and more intimately combined till they seem blended into and constituting one substance. What we ought to signify, then, when we speak of the parenchyma of the lungs, liver, or of any complex organ, is that part of it in which all its Component Systems are so mingled into one Substance that they cannot be distinguished or separated.

But, some authors make out, that this Complex Substance is something superadded to the constituents ; and they would say, that besides the different systems which we have just enumerated as composing the lung, there is joined with them something more, which they call a particular parenchyma. But, this particular something exists only in their imagination. They are not satisfied with the Anatomical

constituents they see enter an organ; and because our eyes do not permit us to trace their ultimate union with each other, declare, that where they cease to be able to distinguish them as distinct parts, there must exist something more. Now, when we mix Tartaric Acid with Carbonate of Soda, and that a tartrate of Soda is formed, we cannot see how they unite or distinguish them when united; yet, we are satisfied that its component parts are Tartaric Acid and Soda, and nothing more. So ought we to be with the component parts we see enter a complex organ. It is just as wise to admit an additional parenchyma in the one case as the other. Let this word, then, never indicate any thing more than the substance of an organ in its collective composition.

It remains for me to say a few words on the plan my able colleague, (Mr. Malyn) and I intend to adopt in teaching Anatomy. We think that its study and acquisition may be greatly facilitated, by making the general notions of function precede the dissection of parts: so that the mind may be excited by constant expectation and enquiry, as you proceed in the mechanical analysis. We are convinced, that when a student asks himself what he shall find; what ought to exist to fulfil certain uses generally known and taken *à priori;* he will acquire the greatest possible amount of knowledge in the least possible time: and what is equally important, it will be so arranged in his mind, that he can call it forth whenever necessary. The idea of function will be so associated with all the mechanical structure necessary for its exercise, that the details of the latter will present themselves in a regular train. He will then be able to apply in his examinations, in his studies, and in his practice, positive knowledge by a sure and ready method; and will scorn to rely on those unconnected appeals to the memory, which are the indications of a superficial man, and which, in the hour of trial, are as useless as they are derogatory.

What organ shall we take to illustrate my meaning? A Gentleman mentions the Eye. Well, every body knows that we see by means of the Eye, and that it is so constituted as to receive the images of objects by what we call Light. Sensation and Light, then, are the data which immediately call up all that relates to the structure of the Eye. In the first place, we must have the part to receive the impressions of images; this, the most essential of all, is the Retina; and its form will, of course, be such as to admit of its receiving the greatest possible

number of images. Secondly, we require that it should be protected and its form preserved: You see how well the Sclerotica answers the purpose. But the light must pass through to the protected Retina: well, then, adapt to the front of this a transparent substance, a glass, and you have the Cornea translucida. Further, it is necessary these parts should be nourished with blood, so as not to interfere with such a delicate function: This has been affected by the delicate choroid coat. Again, the Light requires to be measured according to its intensity, and admitted only in due quantity: and we see this same Choroid dropping down in the form of a curtain, and modified so that the light itself will draw it more or less according to circumstances. It is of great advantage that the light should be concentrated on the Retina in a proper focus, so that the image may be distinct: and for this purpose the lens is placed behind the iris. Finally, the proper distances between all these parts and the natural form of the organ must be preserved by transparent substances: and so they are by the aqueous and vitreous humours. And, thus we might synthetically construct the eye, in all its minute and beautiful contrivances, before we dissected it. Now, let me ask, which of two students would have the best knowledge of it, he who proceeded according to this plan; or he, who, without his mind prepared to intentness, dissected the organ without any reference to its functions?

Gentlemen, I have trespassed long on your attention; and this, of necessity, has been the lecture most trying to your patience of all I shall have to deliver; because it was my duty to make it as complete a foundation as possible for our future investigations: and, therefore, I have been compelled to press into it an immense number of facts. There has been little room for illustration or for any display of eloquence, had the lecturer possessed it. Still, I take my leave of you with the conviction, that you consider Anatomy one of the most interesting as well as most important Sciences. A wide field is before you; and, although some of its paths are rugged, difficult, and not without danger, there are flowers enough strewed in others to encourage you to proceed. Let it be your endeavour to make yourselves acquainted with all that is known in Anatomy, and to enlarge its boundaries by fresh discoveries.

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